

REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 19 to recite that at least one of the first constituent element and the second constituent element includes the dissolution promoter for the protective film-forming agent. Thus, claim 19 requires that in the recited method, the dissolution promoter for the protective film-forming agent be included in the metal-polishing liquid produced.

In addition, new claims 37-55 are being added to the application. Claim 37, dependent on claim 1, recites that the dissolution promoter promotes dissolving of the protective film-forming agent in water. Claims 38 and 39, dependent respectively on claims 3 and 2, respectively recites that each ingredient of the ingredient group is a different ingredient; and recites that the protective film-forming agent, the dissolution promoter, the oxidized-metal etchant, the oxidizing agent and water are different ingredients. Claim 40, dependent on claim 1, further defines the protective film-forming agent, in light of the description in the paragraph bridging pages 15 and 16 of Applicants' specification; and claims 41-45, dependent respectively on claims 40, 41, 42, 41 and 41, further define the dissolution promoter, as a surfactant and/or solvent. Claims 46 and 47, each dependent on claim 1, each further define the dissolution promoter as a solvent, reciting solubility of the protective film-forming agent in the solvent.

In connection with the claims further defining the dissolution promoter, note, for example, pages 10-14 of Applicants' specification.

New claim 48, dependent on claim 12, further defines the protective film-forming agent as discussed previously in connection with claim 40. And new claims 49-53, dependent respectively on claims 48, 49, 50, 49 and 49, further define the

dissolution promoter as a surfactant and/or solvent; in connection with claims 49-53, note previously discussed claims 41-45. Claims 54 and 55, each dependent on claim 12, recites that the dissolution promoter is a solvent for the protective film-forming agent, further defining solubility of the protective film-forming agent, corresponding to claims 46 and 47.

Applicants respectfully traverse the rejection of previously considered claims under 35 USC §102 as anticipated by the teachings of U.S. Patent No. 5,770,095 to Sasaki, et al., and respectfully submit that all of the claims now presented for consideration by the Examiner patentably distinguish over the teachings of the reference applied by the Examiner in rejecting claims in the Office Action mailed May 8, 2003, that is, the teachings of Sasaki, et al., under the requirements of 35 USC §102 and 35 USC §103.

It is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested such a metal-polishing liquid material as in the present claims, including an oxidized-metal etchant and a protective film-forming agent, and wherein this liquid material further includes a dissolution promoter for the protective film-forming agent. See claim 1.

In addition, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such a liquid material as discussed previously, and in particular, wherein the material further includes at least one of an oxidizing agent and water. See claim 2.

Furthermore, it is respectfully submitted that the applied reference would have neither taught nor would have suggested such liquid material as in the present claims, including the ingredient group consisting of the recited components including the protective film-forming agent and the dissolution promoter, and wherein the ingredient

group is in a divided state of two constituent elements not mixed. See claim 3.

Moreover, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such liquid material as in the present claims, including wherein the dissolution promoter is a surfactant (note, e.g., claims 4 and 42); more specifically, wherein such dissolution promoter is such surfactant as set forth in, e.g., claims 5 and 43.

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such liquid material as in the present claims, having features as set forth previously in connection with claim 1, and wherein the dissolution promoter is a solvent, having solubility for the protective film-forming agent as in, for example, claims 6, 9, 44, 46 and 47; and/or wherein the dissolution promoter is a solvent and is selected from the group consisting of alcohols, ethers and ketones (note, e.g., claims 8 and 45).

Attention is particularly directed to claims 40-45, further defining the protective film-forming agent and the dissolution promoter. Particularly with respect to these claims, it is respectfully submitted that the applied reference of Sasaki, et al. would have neither disclosed nor would have suggested these features of the present invention.

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such metal-polishing liquid material as in the present claims, wherein at least part of the protective film-forming agent is solid, having a mean particle size of at most 100  $\mu\text{m}$ . See claim 10.

Moreover, it is respectfully submitted that this applied reference would have neither disclosed nor would have suggested such a metal-polishing liquid (for example, a dilution of the recited metal-polishing liquid material), including the oxidizing agent, oxidized-metal etchant and water, and also the protective film-forming agent and a

dissolution promoter therefor. See claim 12.

In addition, it is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested the additional features of the present invention directed to the metal-polishing liquid, as in claims 13-16 and 48-55, containing features discussed previously in connection with the claimed metal-polishing liquid material of claims 1-11 and 40-47.

Furthermore, it is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a method for producing a metal-polishing liquid, or a polishing method using this liquid, as in various of the present claims, the liquid being formed through use of a liquid material including, inter alia, a protective film-forming agent and a dissolution promoter for the protective film-forming agent, the method including a step of diluting the metal-polishing liquid material with a diluent, for example, an aqueous solution, for dilution of at least one ingredient of a ingredient group consisting of an oxidizing agent, an oxidized metal-etchant, the protective film-forming agent and the dissolution promoter. See claim 18; note also claim 19. See, further, claim 26.

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested the additional features of the method for producing a metal-polishing liquid, as in the present claims, including wherein the diluent is water or an aqueous diluent solution (see claim 20); and/or wherein at least the protective film-forming agent and the dissolution promoter are included in the first constituent element (note claims 21 and 22); and/or temperature of the oxidizing agent and oxidizing agent-containing mixture during the mixing (see claim 23; note that by keeping the, e.g., oxidizing agent, such as hydrogen peroxide, at a temperature of at most 40°C, stability of the liquid is improved); and/or wherein at least a part of the

protective film-forming agent is solid, having a mean particle size of at most 100  $\mu\text{m}$ , and is dissolved or dispersed in the metal-polishing liquid in the mixing step (see claim 24).

In addition, it is respectfully submitted that the applied reference does not disclose, nor would have suggested, such a polishing method as in the present claims, including use of the metal-polishing liquid comprising, inter alia, the protective film-forming agent and dissolution promoter (see claim 25); and/or wherein the polishing method includes, prior to the polishing step, a mixing step as recited in claim 26.

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such liquid material or liquid, or such method of forming the liquid or such polishing method, as in the remaining claims, including (but not limited to) features as in claims 27-36.

The present invention is directed to a metal-polishing liquid material, metal-polishing liquid formed therefrom (for example, by adding a diluent thereto), and a method of forming such liquid and a method of polishing using such liquid.

With recently developed microfabrication techniques for large scale integrated circuits, chemical mechanical polishing (CMP) has been developed, e.g., for microfabricating copper alloy wirings and interconnections. One general method of CMP of metal includes sticking a polishing pad on a circular platen, soaking it in a metal-polishing liquid, setting a substrate having a metal film formed thereon to the polishing pad to keep the metal film in contact with the pad, and rotating the platen while a predetermined pressure is applied to its back to thereby remove the excess metal film owing to the mechanical friction between the polishing liquid and the projecting areas of the metal film. The metal-polishing liquid for CMP generally includes an oxidizing agent and solid abrasive grains, optionally containing an oxidized-metal

etchant and a protective film-forming agent. A basic mechanism of the CMP is described in the paragraph bridging pages 2 and 3 of Applicants' specification.

Various problems arise in connection with use of conventional CMP. Some of these problems are due to the abrasives commonly used. Others arise in connection with costs in transporting and storing the metal-polishing liquids, since most of this liquid is water and the liquid requires a large space.

Problems in connection with storing and transporting relatively large amounts of the metal-polishing liquid can be solved when a concentrate of the metal-polishing liquid can be prepared, as described in the paragraph bridging pages 4 and 5 of Applicants' specification.

Moreover, as a further technique for CMP, there has been proposed a method of using a metal-polishing liquid that includes aminoacetic acid, for example, glycine or amidosulfuric acid serving as an oxidized-metal etchant, and benzotriazole serving as a protective film-forming agent. However, since solubility in water of the benzotriazole is low, metal-polishing liquids as discussed in this paragraph could not be concentrated into concentrates sufficient to have advantages in transporting and storing the concentrate.

Against this background, Applicants provide a metal-polishing liquid material, and metal-polishing liquid formed therefrom, which can include a protective film-forming agent such as benzotriazole, and yet which can be formed as an advantageous concentrate. Applicants have found that by including a dissolution promoter for the protective film-forming agent in the liquid material and liquid, the desired concentrate can be achieved. Moreover, it is easy to prepare the metal-polishing liquid from, for example, a liquid material according to the present invention, by diluting the material with, e.g., water and/or an aqueous solution, and optionally adding thereto any

additional ingredients. Note the paragraph bridging pages 6 and 7 of Applicants' specification. Note also the first full paragraph on page 7 of Applicants' specification.

Accordingly, by the present invention, using, inter alia, the dissolution promoter, together with the protective film-forming agent and, e.g., oxidized-metal etchant, the metal-polishing liquid material having a high concentration can easily be provided, and a metal-polishing liquid according to the present invention can be readily prepared from this liquid material by adding, e.g., a diluent. The liquid material, having a high concentration, has advantages in that the costs for producing the liquid can be reduced, capacity of tanks for transporting the liquid can be reduced, and capacity of the tanks for storing, transporting and using the liquid in polishing plants can be reduced. Moreover, by including the dissolution promoter, material for the metal-polishing liquid may have a broader and higher concentration, providing greater flexibility of polishing capabilities of the liquid. Note, for example, page 9, lines 12-23 of Applicants' specification. See also page 51, lines 6-17 of Applicants' specification.

Sasaki, et al. discloses a polishing agent for use in a microprocessing step such as a semiconductor device manufacturing step, and a polishing method using such polishing agent. The method includes steps of forming a film made of material containing a metal as a main component on a substrate having depressed portions on the surface so as to fill the depressed portions with the film; and polishing the film by a chemical mechanical polishing method using a polishing agent containing a chemical agent responsible for forming a protective film on the surface of the film by reacting with the material containing a metal as a main component, thereby forming a conductive film in the depressed portion. Note the paragraph bridging columns 1 and 2 of this patent. This patent further discloses that the polishing agent includes a chemical agent responsible for forming a protection film on the surface of the substrate to be polished

by reacting with the material containing a metal as a main component. See column 2, lines 7-15 of this patent. Note also column 3, lines 38-54 of this patent, describing chemical agents forming a protection film, these chemical agents including benzotriazole. Note also the paragraph bridging columns 3 and 4 of this patent, disclosing that the polishing agent also includes an etching agent for the material containing a metal as a main component. Note further column 4, lines 50-53 of this patent, disclosing a preferred polishing agent that contains an aminoacetic acid and/or an amidosulfuric acid, an oxidizing agent, water and benzotriazole or a derivative thereof. Note also column 5, lines 4-16; and column 8, lines 11-39, of this patent.

It is respectfully submitted that Sasaki, et al. would have neither taught nor would have suggested such liquid material or such liquid, or such method of forming the liquid or of polishing using such liquid, as in the present claims, including, inter alia, wherein the liquid material includes the dissolution promoter for the protective film-forming agent, in particular, includes this dissolution promoter and the protective film-forming agent.

On page 2 of the Office Action mailed May 8, 2003, the Examiner refers parenthetically to "hydrogen peroxide", with respect to the dissolution promoter for the protective film-forming agent, in Sasaki, et al. Applicants respectfully traverse any conclusion by the Examiner that hydrogen peroxide functions as a dissolution promoter for the protective film-forming agent, in Sasaki, et al. As further recognized by the Examiner on page 2 of the Office Action mailed May 8, 2003, hydrogen peroxide is an oxidizing agent. It is respectfully submitted that Sasaki, et al. would have neither taught nor would have suggested the presently claimed invention, including, inter alia, incorporation of the dissolution promoter for the protective film-forming agent.

In referring parenthetically to hydrogen peroxide in connection with the dissolution promoter for the protective film-forming agent, the Examiner does not refer to any specific portion of Sasaki, et al. as disclosing such functioning as a dissolution promoter. If the Examiner maintains this rejection, the Examiner is respectfully requested to set forth reasons for the conclusion that the hydrogen peroxide is a dissolution promoter as in the present claims. See 35 USC §132.

Furthermore, it is respectfully submitted that Sasaki, et al. is concerned with the polishing agent as a whole, and a polishing method using this agent. It is respectfully submitted that this reference does not disclose, nor would have suggested, the problems in connection with transport and storage of the polishing agent, and does not discuss concentrates; and it is respectfully submitted that this reference does not disclose, nor would have suggested, such method as in the present claims, including use of the diluent, and/or wherein various ingredients of the liquid material/liquid are provided in an unmixed state.

The Examiner points to column 12, lines 50-55 of Sasaki, et al., as teaching a dissolution promoter which is a surfactant. It is respectfully submitted, however, that the specific portion of column 12 referred to by the Examiner describes a coolant circulation path 41, which is a closed system for the polishing table 14 (being within the polishing table 14). Such disclosure of a coolant such as water or ethylene glycol would have neither taught nor would have suggested the surfactant forming part of the liquid material/liquid, as in the present invention.

The contention by the Examiner that column 11, lines 25-30 of Sasaki, et al. discloses a dissolution promoter being a solvent, is respectfully traversed.

Column 11, lines 25-30 disclose a polishing agent of dispersed silica grains (polishing grains) in a mixed solution (a Cu etching solution) of glycine and aqueous hydrogen

peroxide solution, followed by adding benzotriazole. Such disclosure does not teach, nor would have suggested, a dissolution promoter for the protective film-forming agent, much less wherein the dissolution promoter is a solvent, particularly having solubility as in various of the present claims, and/or wherein the solvent is at least one of alcohols, ethers and ketones as in various of the present claims. Reference by the Examiner to ethylene glycol in column 12, lines 50-55 of Sasaki, et al., with respect to these solvents, is noted. It is again emphasized that the ethylene glycol in the coolant circulation path 41 acts as a coolant and clearly is not a solvent of the polishing agent.

Contrary to the conclusion by the Examiner, it is respectfully submitted that Sasaki, et al. would have neither disclosed nor would have suggested a part of the protective film-forming agent being solid and having a mean particle size of at most 100  $\mu\text{m}$ . Column 11, lines 25-65 of Sasaki, et al. discloses silica grains (polishing grains) having a specific size, in the polishing agent. Clearly, the silica grains are abrasive grains in the polishing agent in Sasaki, et al.; and such disclosure would have neither taught nor would have suggested wherein at least a part of the protective film-forming agent is solid, much less that a part of such agent has a mean particle size as in various of the present claims.

Reference by the Examiner to column 4, lines 1-5 of Sasaki, et al., with respect to a diluent, is noted. Such portion of Sasaki, et al. discloses an etching agent and an oxidizing agent; and it is respectfully submitted that such disclosure would have neither taught nor would have suggested the method according to the present invention, including use of the diluent, and advantages thereof as discussed previously, including advantages in connection with transportation and storage.

In addition, attention is respectfully directed to various of the present claims, reciting specific materials for the protective film-forming agents, and for solvents and/or

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surfactants of the dissolution promoter. Particularly in connection with these claims, the disclosure of Sasaki, et al. would have neither taught nor would have suggested the presently claimed invention.

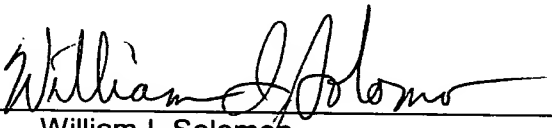
In view of the foregoing comments and amendments, reconsideration and allowance of all claims remaining in the application are respectfully requested.

If the Examiner believes that there are any other points which may be clarified or otherwise disposed of either by telephone discussion or by personal interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account No. 01-2135 (Case No. 566.40319X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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